Cryoanalgesia for intractable perineal pain[1]

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Summary: Cryoanalgesia, the local application of extreme cold to nerves to produce analgesia, has been used to treat patients with intractable perineal pain. The cryoprobe was inserted percutaneously through the sacral hiatus into the sacral canal to produce anaesthesia of the lower sacral nerve roots. Forty patients received a total of 70 treatments: 31 patients (78%) were helped by the procedure and the median duration of improvement was 30 days. The treatment was more successful in relieving symptoms in patients suffering from pelvic cancer and coccydynia. The best results were obtained in those patients who received numerous freeze applications or prolonged freezing.

Introduction

The numbing effect of cold has been known to man since the earliest times (Jones 1931). The local application of ice packs enabled superficial pain to be relieved whilst refrigeration of whole limbs made painless amputations possible (Larre 1832). The introduction by Cooper of the cryoprobe (Garamy 1968), an instrument capable of producing localized tissue freezing, has resulted in the development of techniques for percutaneous location and freezing of nerves (Lloyd *et al.* 1976).

Freezing induces a second degree nerve injury according to Sunderland's (1951) classification. Wallerian degeneration of the axon occurs and conduction is interrupted. As the framework of the perineurium and the epineurium remains intact, nerve regeneration will occur. The duration of block is related to the rate of axonal regrowth and the distance of the cryolesion from the end organ (Beazley *et al.* 1974). In contrast to nerve section or crushing, there are no lasting effects and neuroma formation does not occur.

Patients attending the pain relief unit for treatment of coccydynia and perineal neuralgia frequently fail to obtain relief from drug therapy. Often local anaesthetic injections, including caudal blocks, completely relieve symptoms but the duration of effect is brief. It was felt that a low caudal freeze might offer these patients prolonged relief. We report our results with this technique.

Patients and methods

The patients included in this study all had pain arising in the distribution of the third, fourth and fifth sacral dermatomes. They were considered for cryoanalgesia because they had failed to obtain adequate pain relief from other therapy. They were divided into three groups:
Cancer: These were patients who had obvious spread of their tumours into the sacrum or perineal soft tissues. They usually complained of constant severe deep-seated pain.
Coccydynia: These patients usually presented with a chronic dull ache around the coccyx. Symptoms were frequently aggravated by bending or sitting and most gave a history of previous trauma to the coccyx. Commonly these patients had undergone a coccygectomy.

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Perineal neuralgia: These patients were the least well defined. They were mainly women and usually complained of constant burning sensations commonly affecting the perineum, anus and vagina. Symptoms were gradual in onset, not affected by posture or movement and not relieved by standard analgesics. Most patients had previously had pelvic or gynaecological surgery.

Each patient received a preliminary diagnostic caudal injection of 8 ml of 1.5% lignocaine and only those patients in whom complete relief of symptoms occurred were considered for cryoanalgesia. During the period of the study no analgesics were prescribed for the patients.

The object was to produce bilateral freeze injuries to the posterior primary rami of the lower three sacral nerve roots. In addition it was intended that the anterior primary ramus of the fifth sacral nerve and coccygeal nerve, both of which emerged through the sacral hiatus, would receive freeze injuries. To induce periosteal anaesthesia over the sacrum it was anticipated that it would be necessary to damage the small sinuvertebral nerves, first described by Von Luschka (1850) and subsequently by Hovelacque (1925).

Apparatus

A standard 120 mm needle cryoprobe was used (Spembly Ltd). Nitrous oxide at a working pressure of 45–60 kgf/cm^2 was used as the refrigerant and the gas flow was controlled with a Lloyd-Spembly Neurostat console (Figure 1). The probe temperature was measured with a chromel constantan thermocouple built into the tip. At the maximum gas flow a temperature of $-60°C$ was achieved. A four minute freeze at this temperature, *in vitro,* produced a 6 mm iceball (probe surface to ice interface with tissues).

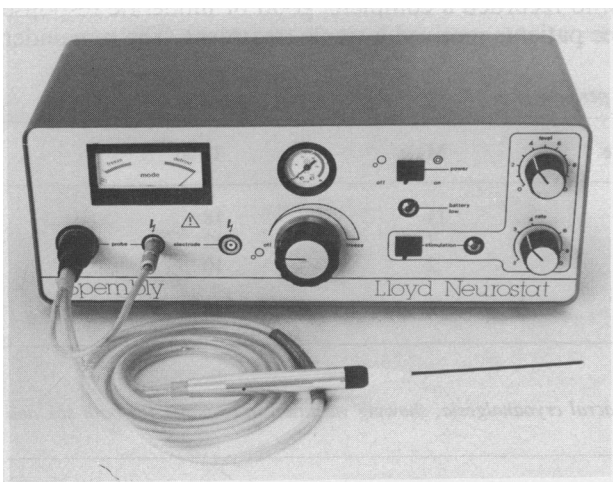

Figure 1. Apparatus used for cryoanalgesia

Technique

The patient was positioned prone on a screening table and the sacral area was anaesthetized with 5–10 ml of 1% lignocaine. A 12 gauge 'Medicut' cannula was inserted through the sacrococcygeal ligament and one centimetre into the sacral canal. Correct positioning was determined by biplane X-ray screening. The inner needle was then removed and replaced with the cryoprobe. The plastic cannula acted as an introducer and was subsequently withdrawn up the shaft of the probe to avoid interference with iceball development. Each patient received a pattern of up to six separate three to four minute freezes at different sites. The number chosen was related to the distribution of the patient's pain, but they were frequently paired on

either side of the midline. A common site was at the level of the sacrococcygeal ligament. No freezing was undertaken above the level of the third sacral foramen.

To reduce the incidence of skin freezing, which tended to occur with superficial applications of the cryoprobe, hot water was trickled over the probe entry site during the freeze cycle.

Follow up

Patients were reviewed within 24 hours of the procedure and at approximately one and three months afterwards. Subsequent visits were dictated by their progress. Those who benefited from cryoanalgesia had repeat therapy when pain returned or increased. Patients who had an unsuccessful first freeze were offered a second treatment; if this also failed, alternative methods of pain relief were employed.

A six-point verbal rating scale of pain relief (complete, good, moderate, slight, nil, worse) was used for assessment in conjunction with a global measure of improvement recorded by the physician. Evidence of sensory and motor changes, disturbance of bowel and urinary function and any complications were recorded.

Treatment was considered to have failed when the pain intensity increased or patients requested a return to some analgesic medication.

Results

Forty patients, mean age 59 years, received cryotherapy for relief of perineal pain (Table 1). A total of 70 treatments were given and the results are shown in Table 2. Statistical analysis was made on the basis that those patients who recorded a complete, good or moderate response were considered improved. Twenty-three patients received a single treatment. The remainder

Table 1. Distribution of the 40 patients suffering perineal pain

Diagnosis	Female	Male	Total
Cancer	7	11	18
Coccydynia	11	1	12
Perineal neuralgia	8	2	10
Total	26	14	40

Table 2. Results of treatments undertaken with sacral cryoanalgesia, showing variation in response for both sex and condition

		Subjective evaluation of pain relief					
Diagnosis	Sex	Complete	Good	Moderate	Slight	Nil	Worse
Cancer	M	7	6	1	1	1	0
	F	1	4	2	0	2	1
Coccydynia	M	1	0	0	0	0	0
	F	6	5	6	2	4	2
Perineal neuralgia	M	0	0	2	0	1	0
	F	1	2	1	1	9	0
Total●		16	17	12	4	17	3

●Data not available on one treatment

had repeat therapy either because the initial treatment proved ineffective or because pain returned. Nine patients received cryotherapy twice, 6 underwent three treatments and 2 women had five and six treatments each respectively.

Thirty-one patients (78%) were helped by cryoanalgesia. The mean duration of improvement was 39 days (Table 3). Eleven patients gained complete relief of symptoms (mean relief 16 days) and most had some sensory loss over the lower sacral dermatomes, thus confirming that a freeze injury had occurred. Eight of the patients who recorded good or moderate improvement from the procedure also developed sensory changes mainly affecting the small area of skin around the probe entry site. The sensory interruption was usually brief and never lasted more than 30 days. The remaining patients suffered no objective sensory or motor changes and none noticed any disturbance in bowel or urinary function.

Eleven patients were not improved after the first application of the cryoprobe; 6 of these accepted a second treatment and 3 gained a useful reduction in pain. Other patients also failed to obtain relief during subsequent cryotherapy and of the 70 treatments undertaken 24 proved ineffective. The total duration of freezing (No. of freezes × minutes) was an important factor (Table 4). Those patients who received prolonged freezing obtained better results ($P<0.02$, chi-square analysis).

The effectiveness of treatment varied within the groups. Cancer patients responded well. Improvement followed 21 of the 26 treatments performed, whilst only 6 of the 17 treatments were helpful in relieving symptoms in those patients suffering from perineal neuralgia ($P<0.02$ chi-square analysis).

The procedure was well tolerated by the patients and none found it unpleasant. Nine patients suffered minor problems following the procedure: these included superficial infection and slight bleeding, none of which required treatment and all resolved within 48 hours. One patient suffered a prolonged CSF leak from the probe entry site. The patient had an extensive bladder carcinoma which had eroded over half the sacrum and it was felt that the tumour was responsible for the CSF loss. It was unlikely that the insertion of the cryoprobe up to the level of the third sacral foramen would have caused a dural puncture. This patient's leak was eventually controlled by the insertion of a 20 ml extradural blood patch through the second posterior sacral foramen.

Table 3. Mean duration of relief and range following cryoanalgesia

	Number of treatments	Mean duration (s.d.) in days	Range in days
Complete relief	16	16 (23)	1–90
Improved	29	39 (41)	1–180
No relief	24	—	—

Table 4. Effect of duration and number of sites frozen on pain relief provided by sacral cryoanalgesia

Total duration of freeze●			Number of freeze sites●		
Time (min)	Improved	No relief	Number	Improved	No relief
1–8	20	17	1–4	31	19
>8	19	3	>4	8	1
$P<0.02$ (chi-square)			$P<0.02$ (chi-square)		

●Details of 11 treatments not available

Discussion

Cryoanalgesia, a technique introduced in 1976, is a safe repeatable method for producing pain relief and has a low incidence of side effects. Certainly, where the nerve is exposed and frozen, a prolonged and predictable period of anaesthesia occurs (Evans *et al.* 1980). The reports of its use for the control of intractable pain are few, but Barnard *et al.* (1978) demonstrated that it was beneficial in relieving facial pain.

The majority of patients (78%) in this study were improved by cryotherapy. This was a subjective evaluation based on a six-point ordinal scale, yet all these patients had suffered long-standing pain and most had previously failed to respond to other therapy. Whilst prolonged and complete relief of symptoms was always pleasing to see, the main aim of therapy was to reduce the level of pain to one which no longer inhibited normal activity. It is likely that the use of a linear analogue scale would have provided more detailed results but in view of the long intervals between reattendance, the wide fluctuations in pain intensity seen in patients with intractable pain and the generally poor compliance at form completing, it was felt that a simple ordinal scale would provide a fair assessment of the treatment's success or failure.

The duration of relief afforded by cryoanalgesia was wide-ranging and it is possible that some patients may have demonstrated a placebo effect. The median duration of pain relief was short (30 days) although a few patients obtained prolonged benefit (up to 180 days). These results were, however, consistent with those recorded following the use of cryoanalgesia in the management of other chronic pain conditions (Lloyd *et al.* 1976). The fact that even a temporary interruption in the pain could be achieved was a great boost both physically and psychologically for the patients, although it was regrettable that it was not possible to predict which patients would obtain sustained relief.

The treatment proved more effective for those patients suffering from pelvic cancer or coccydynia, where there was a reasonable organic basis for the pain, and less effective for those patients with perineal neuralgia where symptoms frequently included a large functional component. This was also reflected by the fact that women, who often had more functional symptoms, were less frequently relieved of pain by cryoanalgesia.

Only a few patients obtained complete relief of pain and often more than one treatment was necessary to produce a good result. This could be explained by the difficulty in achieving sufficient nerve destruction following the cryoinjury. It was noted that those patients who were symptom free had anaesthesia of the sacral dermatomes and this was the only clinical confirmation of a nerve injury. However, the extent of the damage to the sinuvertebral nerves and to the autonomic nervous system could only be assessed in terms of symptom relief. Frequently the duration of relief was short and this may have occurred because an inadequate nerve freeze only caused a neuropraxia, whereas more extensive freezing would have resulted in the classical second degree injury.

The major difficulty when using a percutaneous technique to induce a cold injury to nerves is being able to guarantee that the probe is adjacent to the nerve. Cell damage will only occur within a few millimetres of the probe surface (Smith & Fraser 1974). Lloyd *et al.* (1976) demonstrated that the use of a peripheral nerve stimulator is helpful for either locating the nerve or inducing the patient's pain. However, the use of local anaesthesia to the sacral region resulted in the loss of this assessment parameter and it became necessary to rely on correct X-ray positioning of the probe adjacent to the foramina and the performance of multiple freeze cycles to obtain successful results.

The fact that a number of patients failed to get relief of pain following the procedure and yet all had been symptom free following the caudal block suggests that not all the nerves had been included in the area of tissue frozen by the probe. There is naturally a compromise between the size of the probe and the size of the iceball (Evans 1981). This can be overcome, when using small probes, by performing multiple freezes to adjacent areas of tissue, thus effectively increasing the size of the cryolesion. Unfortunately this approach has limitations, particularly when freezing is superficial, e.g. sacral cryoanalgesia, as excessive skin freezing

may occur caused by retrograde freezing along the body of the cryoprobe. In many patients this presented a restriction of the duration and number of freezes undertaken at a particular treatment. Recently a reverse flow probe (Spembly Ltd) has been introduced and although it produces a smaller iceball when compared with the standard probe it does not cause any skin freezing. It is now hoped that this multiple-site approach to freezing can be safely adopted and that, by extending the duration of freezing, future results will be even more encouraging.

Conclusion

Freezing provides an effective method of producing a prolonged interruption of nerve conduction. It is a simple technique easily applied and where the nerve is readily accessible produces excellent results. It has distinct advantages over other methods such as nerve section or crushing. It is reversible, does not lead to neuroma formation and of course can be applied percutaneously. Unlike the peripheral use of both phenol and alcohol, it has no tendency to cause a neuritis and should pain return when sensation returns the technique can be safely repeated without any ill effects.

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